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San Francisco-Oakland Bay Bridge East Span Seismic Safety Project
SAS Constructability Workshop
Monday, May 13, 2002 – 8 a.m. to 5:00 p.m.
Marriot Hotel, Oakland, California

OVERVIEW

The California Department of Transportation (Caltrans), District 4 conducted the SAS Constructability Workshop to provide a forum for information sharing and discussion related to fabrication of the tower and two orthotropic boxes for the San Francisco-Oakland Bay Bridge East Span Seismic Safety Project. Construction of this project is scheduled to begin in 2003. These fabricated items are included as part of a larger construction project, SAS/YBI 04-012064.

Approximately 50 structural plate steel suppliers, fabricators and prime contractors attended the workshop. The handout from March 15 Contractor Outreach was distributed to all attendees. This handout has selected (draft) plans, specifications and geotechnical information about the SAS/YBI contract. PowerPoint presentation were conducted that included information on steel design, steel specifications, welding and testing. The participants chose to modify the workshop agenda to increase the amount of time for discussion. Open discussion related to constructability concerns with fabrication and erection of the tower and orthotropic boxes of the Suspension Span. Some attendees were not vocal; their silence should not be construed to be agreement with what was said.

NOTICING

Approximately 40 potential participants were informed by mail of the conference location, date, and time. The notice was also posted on the toll bridge web page.

The meeting presentation, list of attendees, and this meeting summary is post at www.dot.ca.gov/hq/esc/tollbridge/.

Opening Remarks by Paul Hensley

- In 1989 we had a major earthquake that closed the SFOBB for about 30 days. This had a major economic impact on the Bay Area. This event also caused us to review the safety of all \$2.6 billion dollars will be spent to replace the east span of the SFOBB.

- Of the transportation system throughout the state. This spawned the seismic retrofit program, which today is about \$4.6 billion dollars.
- From 1989 until now, we have had to do a lot of work to get to this point with the SFOBB. We have let the first major contract. We are now working on the self-anchored suspension span portion of the bridge.
- We need to ensure that we are proceeding the best possible way. We want to make sure that we have all the companies involved, that all the information gets out to all potential bidders. We want to see discussion taking place among yourselves, the Caltrans Project manager and others; we all want to hear what you have to say.
- We have a goal to obtain 25% participation of small businesses. We want to track everyone involved in the work. This will be a major economic undertaking in the State of California.
- This bridge will be a major gateway into the City of Oakland. The project represents many things to many people. This is the biggest project we have ever had. It will take us about 7 years to accomplish everything we have under way.

GENERAL MEETING NOTES

The power point presentations and speakers got underway at about 9 am. After the Structures Specifications presentation, there was some time before breaking for lunch. The group discussed the rest of the meeting and voted to change to agenda. The revision to the agenda was to cancel the lunchtime keynote speaker and constructability presentation and start the dialogue from the participants about their constructability concerns. Concerns raised are summarized in the bullets below:

- Contractor comes out fully staffed. => Owner must also have adequate staff
- **Bonding issues for fabricators.** No fabricators can obtain a bond for a job of this size. AIG will not bond for over \$75 million dollars. AIG is the largest *construction* bonding company in the United States. There are high risk and cash flow problems.
- **Cash Flow** This project will require approximately \$125 to \$150 million *dollars*, *fabrication materials, mobilization, etc*) to be spent prior to any construction work being performed on site. There is a need to consider some sort of prepayment.
- **Fabricators** Fabricators need to make payments for mill materials and at various stages of the fabrication, otherwise the cost is absorbed by the general contractor. There needs to be a creative payment method in the first and second year of this project.
- **Project Schedule** A contractor estimated the duration of the schedule to be between 52 and 60 months (4.3 years to 5 years). His estimate for the construction of the SAS is 5 years, and the YBI construction is 2 more years. Shop drawings and detailing acceptance by caltrans is estimated to be 2 years to 2-1/2 years. If it appears that the schedule is unattainable, contractors will estimate in the penalties for exceeding the schedule into the bid.

- **Temporary Ramp Design at YBI** General contractors should not be responsible for temporary ramp design. Contractors do not carry design insurance and expressed his concern that contractors do not have anything to do with the design risk of the traveling public. The concern is that the contractor is not insured for design work. It was suggested that Caltrans design the YBI detours.
- **Can this project be constructed domestically?** There was a discussion among multiple prime contractors whether the fabrication of the orthotropic boxes, tower and other steel components can be produced domestically. It was suggested that the temporary structures be fabricated internationally rather than the tower and boxes.
- **Tower Erection** Because of The tower's weight (1,500 tons) and height (500 feet tall), it cannot be erected with an available crane. Also, the crane must be operated from a domestic fleet, as The Jones Act is applicable. Constructing a crane in the USA for project specific purposes would take 3 years at a cost of \$45 to \$50 million dollars. The crane would have no future use (*salvage value*). Lifts at 250, 300 to 400 tons are more suitable. Also, Caltrans must consider booming in lift calculations.
- **Staging construction projects** Contractors suggested breaking up the project SAS/YBI 012064 into 3 smaller efforts with the YBI portion being a separate project and the pier construction including the Skyway project.
- **Marine Mobilization** An additional 10% is added to cost of the project for marine mobilization.
- **State of Maryland Specification** Contractors requested Caltrans to look into Progress Payment section in the State of Maryland Specifications. NSBA suggested State of Maryland had some examples on lifts and transport of material that could be helpful. Arun Shirole offered to assist.

Challenges 1,500 ton piece to handle in shop. Material from the mill: upper bound on strength is a problem. (Exchange within the group seemed to solve, or at least help this problem. It was stated that US Steel would run smaller lots high performance steel desired.)

- Buy America – We don't know how many bidders we will have. Need to break the project into smaller pieces so we can get more bidders. Message is that the field of bidders will be unacceptably small if there are not changes made.
 - Construction Engineering. The specs should either be performance specs or method specs, but not mixed. Suggested 5 or 6 splices in tower would be desirable.
 - All internal structures will be within 5mm (tolerance requirement). Why? (Warren). For floor beam web this is within 0.25% vertically. Request to revise dimensional tolerances on all items. What is appropriate? Where did tolerance come from? Carquinez? Distortion and shrinkage on these members is in excess of 5mm. What can the designers live with? How is this or is this being verified in the field (at Carquinez)? Warren: The point is to avoid unnecessary repairs. They are counter-productive. Don't repeat the code in the special provisions - Refer to it only.

Tower construction and airport/flight issues. Transponders/lighting requirements. Temporary crane tower would extend 100 to 150 ft above top the main tower. Note: Tower can be fully erected prior to beginning orthotropic box superstructure erection.

Fabrication and Welding procedures

- **Fabrication and Welding procedures.** Some believe that Caltrans Specifications are not workable and require unreasonable practices. Reference was made to the Carquinez Bridge contract specifications 04-013014. Field and shop welds are not equivalent and cannot be inspected such. Pre-Approved welding procedures and personnel are highly desired. AISC and NSBI had strong statements on Caltrans certification program. Participants believe the AISC certification is appropriate, and Caltrans certification is a duplication of the AISC certification. AISC offered to modify their audit and tailor their certification program to Caltrans needs. As the **Fabrication and Weld procedures** specifications become more stringent, Caltrans may not get the product return for the increase dollars spent on meeting the requirements. Fabrication shop and field tolerances need to be challenged. Specifications should not use (*theoretical*) tolerances. Fabrication shops and theoretical university laboratories differ in producing the product, schedule, workforce, and cost. Diaphragm was offered as an example of tolerances. Overly restrictive specifications should not be used if it does not impact the performance of the product. In the welding specification, the engineer can call for extra inspections any time. How much is enough? Why? How do we incorporate this in the schedule? If piece is accepted at the fabrication shop, why inspect again at site?
- **Castings, Main Cable Wire** The cable wires are not available in the USA The cable wire can not be fabricated domestically. The steel industry does not oppose casting or wire waiver from Buy America.
- **Ability of meet 60 ksi limitation on ASTM specifications** U.S. manufacturers may not guarantee the upper 60 ksi (*yield strength?*) per steel (?) specification reference to ASTM.
- Fabricators request Caltrans to review all tolerances and consider feasibility of the product and the extra cost of meeting the tolerances. For example: a piece could be rejected for not meeting the specified tolerance, a tolerance that may not have been necessary, and the 'repaired' product, which is accepted, may not be as good as the piece would have been without the unnecessary tolerance.

Caltrans witnessing for welder qualification appear excessive. It was suggested Caltrans should accept qualified third party qualification witnessing. Independent acceptance witnessing was questioned.

Mr. Arrun offered Las Vegas, Clark County (*projects or specification*) NSBA considered successful.

- **Mock-Ups** Fabricators objected to using wood mock-ups. Wood mock-ups are

costly and a pain. The industry has not been using wood mock-up models for some time. Wood is not steel and cabinetmakers that are qualified to produce the mock-ups cannot be found.

- **Structural Welding** Can substantial conformance for structural welding be defined?
- **Steel Specifications** US Steel representatives commented that specifications should state the physical properties of the material and the acceptable range. US Steel fabricators are willing to work with Caltrans on delivering the end product.
- **Question on Specifications** If a fabricator cannot meet a specification, can fabricators redesign on the fly and adjust the design? Need to specify the weak links up front.
- **Question on Plan Sheet 528** Is #6 in table #2 a heavy lift? Will the contractor be required to do extra analysis of heavy picks?

Pile Caps – Towers – wire

- May Pile Driving Can be used as a template for pile driving? Must hold the pile in two places.
- Pile caps There are a lot of vertical welds. Caltrans is looking into using electroslog welding.
- Audits
- Caltrans to consider to accept AISC certification for this project. Caltrans duplications of audit procedures increase time and cost. Additional elements for audits will not be a problem if there are good reasons for them; they may be incorporated into the AISC audit. Recommendation for AISC to handle audits, qualifications and mock-ups. Caltrans Audits are redundant. Jim Merrill: Assembly Bill requires Caltrans to determine/assure that the fabricator can meet requirements. Gives the owner opportunity. Should not be costly. AISC audit issue: Proposed specifications can result in a 4-month delay.
- Mock up requires certification. AISC could include inspection of mock up. AISC will look at what ever the project requires.
- Audit process could be about 50 days.
- Numerous welds come together in a particular spot – there appears to be opportunity to reduce the size of some of the welds. This will be difficult to build. Look at electro slag? Electro slag will not reduce shrinkage stresses. (Jim Merrill, Caltrans is having meetings to discuss this.) Concern is using Welding Code D 1.1
- Should Caltrans be using offshore welding specs (API)? We are more comfortable working with specs we know. Offshore specification adds an extra layer.
- Plan Sheet 118 – are the vertical field welds full length? No.
- Will we have to drive piles around the structure to support lifting? Can you specify clear distance from the new piles? Two distances – one for large piles and one for small piles would be OK.
- Can Caltrans explain how they contemplated erecting the tower? Can Caltrans confirm, or take responsibility for contractor's lifting methods?

- Field welding – the group is on both sides of allowing it. You can eliminate all milling if the bolts take all the load. Then there will be fit-up problems.
- How will the wires be handled at the deviation saddle? Individual wires have different lengths. Will the wires bird-cage? There is no criterion in the specifications for the fabrication of the strand to accommodate thermal requirements. We need to address the thermal characteristics?
- There will be weld problems and cracking problems in large welds.
- Deck sections can be lifted, but contractor needs to keep tower legs above bridge deck level's lower weight (300-600 tons?) 1,500 tons at 250 feet is high- don't forget about the rigging and blocking.
- There are concerns about distortion on large welds and heat treatment.
- Is there any coordination with the two airports in the area, as far as the height of the tower and the crane used to erect it?
- Skirting – can it be left off until after the tower is completed? Skirting can be left off until after full erection of the tower.
- Can the shear links be used to support loads (equipment) during construction? If they are left in per plan condition (i.e. undamaged).
- Temporary work: Why specify the maximum limitations of temporary structures? (Example: size of piles). Put limitations on temporary structures as performance requirements. Contractor designs temporary work.
- Temporary Detour Structures on YBI: Contractors do not want the liability of this design.
- Welding documentation issues. Production welds are to be inspected at fit-up.
- Specs require that Caltrans witness all WPS and PQR. D1.5 allows engineer to accept witnessing by other agencies.
- Considerable concerns on cable around west end saddles due to length differential around the saddles. Concerns on no thermal control on cable specs.
- Welding Vertical welds? Electro slag welding? Is approval on its way?
- S-wire wrapping system is Nippon Steel Sole Source

The Box

- More freedom for more splices in the girder is desired.
- Take a look at the welding pre-qualification requirements.
- “Specify and document each welder’s performance.” What does this mean?
- Caltrans witnessing of welder qualifications adds time and is costly. Can Caltrans accept other party witnessing?
- Plan Sheet 199 - rib to deck plate weld: CT is asking for 80% weld. There is no reason to prep the edge. There have been no problems to date. Fit-up is critical. Mechanical hold is preferred, and then will provide tack weld. Will remove mechanical to perform subarc.
- On Sheet 199, what is the allowable acceptance criteria on convexity? Determine the allowable or permissible deformation/excessive convexity, and detail it.
- Welding Warping. Should allow heat straightening.

- Welding Procedure requirements: Caltrans should look at the way they average welding parameters.
- All welds are in tension unless otherwise noted. It is easy to miss this.
- Specified tolerances to be within 5 mm. This adds cost and is not necessary. It is possible, but there is no value in doing it. Example: why make diaphragms within 0.25% of vertical? Welding specs will require repairs to things that do not need repair. Caltrans should be very careful to stay within good fabrication practice and codes when it comes to tolerances. But erection tolerances are not necessarily contained in code and some variation may be allowable. Ends of girders may deform but be corrected by the splice plates. There should be tolerances provided. Don't repeat the code tolerances. Be sure there is a reason when adding tolerance requirements. Repeating the code will raise the bids.
- In the fabrication of the box, there will be warping. Warping can be control with best distortion control measures, but it will not lead to zero warping. Fabricator will need to cold bend or heat straighten. No body wants shoddy work, but nothing is perfect.

Working Days

- Under five years is very reasonable. It will be two years before you are ready to start fabrication.
- Seven years to be open to traffic.
- YBI work is 40 to 45 months (3.3 to 3.75 years), driven by staging requirements.
- If you allow too much time, the contractor will take it. Try to get close. Have a reasonable schedule.
- Incentive/disincentive gives the contractor opportunity for timesaving that benefit both themselves and Caltrans.
- A +B is not a good idea. It encourages the contractor to put limitations on the fabricator. It can inadvertently encourage some bidders to find any flaws to provide extra days at the cost of the owner.
- Shop drawing turn around is troublesome. It often takes much longer than the promised ten days.
- Environmental review process and timelines are not workable.
- Caltrans needs to learn to "Approval as Noted." Permit review times are "ludicrous."
- If time is that important use incentive/disincentives.